PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-191218
(43)Date of publication of application : 13.07.1999

(51)Int.Cl. G11B 7/00

(21)Application number : 09-358787
(22)Date of filing : 26.12.1997

(71)Applicant : SONY CORP
(72)Inventor : KOBAYASHI SEIJI
FUJIKI TOSHIHIRO

(54) OPTICAL DISK RECORDING DEVICE, RECORDING METHOD OF OPTICAL DISK, AND OPTICAL DISK

(57)Abstract:
PROBLEM TO BE SOLVED: To avoid illegal copying by copying sub-data columns by varying local reflectance of an information recording surface at a position distant from the edge of the pit or mark by a prescribed distance according to the sub-data columns for recording them, concerning pit and/or land of a prescribed length, or mark and/or space of the length or longer.
SOLUTION: A compact disk 1 is made up by forming a reflective recording surface 3 and a protective coat 4 on a disk substrate 2. At this time, it is constituted so that a same film structure as that for a CD-R information recording surface is applied to the reflective recording surface 3, and when it is irradiated with a laser beam L of ≥ a prescribed quantity of light, the reflectance of the reflective recording surface 3 at the laser beam emitting position changes reversely, and the sub-data can be recorded in addition to the main data recorded by repeating bit and land. Thus, it is made difficult to illegally reproduce the main data columns without exerting any influence thereon but it is possible to record the sub-data columns.

LEGAL STATUS

[Date of request for examination] 17.07.2000

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection

or application converted registration]
[Date of final disposal for application]
[Patent number] 3454410
[Date of registration] 25.07.2003
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The pit and the land or mark, and tooth space by the die length according to the main data streams are repeated by the information recording surface. A light beam is irradiated to the disk-like record medium with which said main data streams were recorded. said pit more than predetermined die length -- and -- or a land or said mark -- and -- or in the part which estranged only predetermined distance from said pit or the edge of a mark about the tooth space based on the data stream of ** The optical disk recording device characterized by changing the reflection factor of said information recording surface locally, and recording the data stream of said ** on said disk-like record medium.
[Claim 2] said two or more pits -- and -- or a land or said mark -- and -- or the optical disk recording device according to claim 1 characterized by repeating and recording 1 bit of the data stream of said ** on a tooth space.
[Claim 3] The optical disk recording device according to claim 1 characterized by recording the data stream of said ** on said disk-like record medium by changing the reflection factor of said information recording surface locally according to the data stream which modulates the data stream of said ** with an M sequence random number, and is obtained.
[Claim 4] The optical disk recording device according to claim 1 characterized by said predetermined distance becoming in the distance D expressed by the degree type.
[Equation 1]

However, NA is the numerical aperture of the optical system which reproduces said main data streams here, and lambda is the wavelength of the light beam applied to said optical system.

[Claim 5] Said predetermined distance is an optical disk recording device according to claim 1 characterized by becoming by the shortest die length of said pit formed in said disk-like record medium and a land or said mark, and the tooth spaces.
[Claim 6] The data stream of said ** is an optical disk recording device according to claim 1 characterized by becoming by the discernment data stream which identifies said disk-like record medium.
[Claim 7] Said main data streams are optical disk recording devices according to claim 1 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.
[Claim 8] The data stream of said ** is an optical disk recording device according to claim 1 characterized by becoming by the data of the count of playback of said main data streams.
[Claim 9] The data stream of said ** is an optical disk recording device according to claim 1 characterized by becoming by the data of the count of a copy of said main data streams.
[Claim 10] the return light obtained by irradiating a light beam -- being based -- the pit more than said predetermined die length -- and -- or a land or a mark -- and -- or a tooth space being detected and with a detection means to output a detection result said detection result -- being based -- said light beam -- the pit more than said predetermined die length -- and -- or a land or a mark -- and -- or the timing which scans a tooth space being predicted and with a timing prediction means to output a prediction result The optical disk recording device according to claim 1 characterized by starting the quantity of light of said light beam temporarily, and having a quantity of light switch means to change the reflection factor of said information recording surface locally, based on said prediction result and the data stream of said **.
[Claim 11] the return light obtained by irradiating a light beam -- being based -- the pit more than said predetermined die length -- and -- or a land or a mark -- and -- or a tooth space being detected and with a detection means to output a detection result the pit corresponding to said detection result of having held said detection result for a storage means to hold temporarily, and said storage means -- and -- or a land or a mark -- and -- or with the control means which makes a tooth space scan said light beam The optical disk recording device according to claim 1 characterized by starting the quantity of light of said light beam temporarily, and having a quantity of light switch means to change the reflection factor of said information recording surface locally, based on said detection result held for said storage means, and the data stream of said **.
[Claim 12] The 1st optical system which irradiates the 1st light beam at said disk-like record medium, receives return light, and outputs a light-receiving result, said light-receiving result -- being based -- the pit more than said predetermined die length --

and -- or a land or a mark -- and -- or a tooth space being detected and with a detection means to output a detection result From said 1st light beam by said 1st optical system, carry out backward and the 2nd light beam is irradiated at said disk-like record medium. The optical disk recording device according to claim 1 characterized by starting temporarily the quantity of light of said 2nd light beam, and having the 2nd optical system to which the reflection factor of said information recording surface is changed locally based on said detection result and the data stream of said **.
[Claim 13] A light beam is irradiated at the disk-like record medium with which the pit and the land or mark, and tooth space by the die length according to the main data streams were repeated by the information recording surface, and said main data were recorded. said pit more than predetermined die length -- and -- or a land or said mark -- and -- or in the part which estranged only predetermined distance from said pit or the edge of a mark about the tooth space based on the data stream of ** The optical disk record approach characterized by changing the reflection factor of said information recording surface locally, and recording the data stream of said ** on said disk-like record medium.
[Claim 14] said two or more pits -- and -- or a land or said mark -- and -- or the optical disk record approach according to claim 13 characterized by repeating and recording 1 bit of the data stream of said ** on a tooth space.
[Claim 15] The optical disk record approach according to claim 13 characterized by recording the data stream of said ** on said disk-like record medium by changing the reflection factor of said information recording surface locally according to the data stream which modulates the data stream of said ** with an M sequence random number, and is obtained.
[Claim 16] The optical disk record approach according to claim 13 characterized by said predetermined distance becoming in the distance D expressed by the degree type.
[Equation 2]

However, NA is the numerical aperture of the optical system which reproduces said main data streams here, and lambda is the wavelength of the light beam applied to said optical system.
[Claim 17] Said predetermined distance is the optical disk record approach according to claim 13 characterized by becoming by the shortest die length of said pit formed in said disk-like record medium and a land or said mark, and the tooth spaces.
[Claim 18] The data stream of said ** is the optical disk record approach according to claim 13 characterized by becoming by the discernment data stream which identifies said disk-like record medium.
[Claim 19] Said main data streams are the optical disk record approaches according

to claim 13 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.

[Claim 20] The data stream of said ** is the optical disk record approach according to claim 13 characterized by becoming by the data of the count of playback of said main data streams.

[Claim 21] The data stream of said ** is the optical disk record approach according to claim 13 characterized by becoming by the data of the count of a copy of said main data streams.

[Claim 22] the return light obtained by irradiating a light beam -- being based -- the pit more than said predetermined die length -- and -- or a land -- or a mark -- and -- or a tooth space -- detecting -- this detection result -- the pit more than said predetermined die length -- and -- or a land -- Or the timing to which said light beam scans a tooth space is predicted. or a mark -- and -- The optical disk record approach according to claim 13 characterized by starting the quantity of light of said light beam temporarily, and changing the reflection factor of said information recording surface locally based on this prediction result and the data stream of said **.

[Claim 23] Or detect a tooth space, hold a detection result temporarily, and the same part is scanned again. the return light obtained by irradiating a light beam -- being based -- the pit more than said predetermined die length -- and -- or a land or a mark -- and -- The optical disk record approach according to claim 13 characterized by starting the quantity of light of said light beam temporarily, and changing the reflection factor of said information recording surface locally based on said detection result held temporarily and the data stream of said **.

[Claim 24] The optical disk record approach according to claim 13 characterized by starting temporarily the quantity of light of the light beam which irradiates said disk-like record medium and carries out backward [of 1 set of light beams] based on the playback result by the light beam to precede, and changing the reflection factor of said information recording surface locally.

[Claim 25] The pit and the land or mark, and tooth space by the die length according to the main data streams are repeated by the information recording surface, and said main data streams are recorded. said pit more than predetermined die length -- and -- or a land or said mark -- and -- or the optical disk characterized by for the reflection factor of said information recording surface having changed locally, and recording the data stream of ** from said pit or the edge of a mark about a tooth space in the part which estranged only predetermined distance.

[Claim 26] said two or more pits -- and -- or a land or said mark -- and -- or the optical disk according to claim 25 characterized by recording 1 bit of the data stream of said ** on a tooth space repeatedly.

[Claim 27] The optical disk according to claim 25 characterized by having become irregular with the M sequence random number, and recording the data stream of said

**.

[Claim 28] The optical disk according to claim 25 characterized by said predetermined distance becoming in the distance D expressed by the degree type.

[Equation 3]

However, NA is the numerical aperture of the optical system which reproduces said main data streams here, and lambda is the wavelength of the light beam applied to said optical system.

[Claim 29] Said predetermined distance is an optical disk according to claim 25 characterized by becoming by the shortest die length of said pit and a land or said mark, and the tooth spaces.

[Claim 30] The data stream of said ** is an optical disk according to claim 25 characterized by becoming by the discernment data stream which identifies an optical disk.

[Claim 31] Said main data streams are optical disks according to claim 25 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.

[Claim 32] The data stream of said ** is an optical disk according to claim 25 characterized by becoming by the data of the count of playback of said main data streams.

[Claim 33] The data stream of said ** is an optical disk according to claim 25 characterized by becoming by the data of the count of a copy of said main data streams.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is applicable to the listing device of a compact disk, a compact disk, and a compact disc player, concerning an optical disk recording apparatus, the optical disk record approach, and an optical disk. This invention is the timing which does not affect the positional information of an edge, and copying refreshable depending on an illegal copy by the optical pickup which reproduces this main data stream without affecting playback of the main data streams by a pit train etc. in any way by changing reflective film, such as a pit and a mark, locally enables it to record the data stream of ** difficult.

[0002]
[Description of the Prior Art] Conventionally, by carrying out eight-to-fourteen modulation (Eight to Fourteen Modu1ation), the pit train of periods 3T-11T is formed to the predetermined primitive period T, and the compact disk is made as [record / audio data etc. / by this], after carrying out data processing of the data stream with which record is presented.
[0003] On the other hand, the record section of administrative data is formed in the lead-in groove area by the side of inner circumference, and it is made as [reproduce / a desired performance etc. / alternatively] by TOC (Table Of Contents) recorded on this record section.
[0004] Thus, the sign which shows a manufacturer, a factory, a disk number, etc. is stamped on the inner circumference side of lead-in groove area, and the compact disk with which various data are recorded is made as [check / the hysteresis of a compact disk etc. / by viewing / by this].
[0005]
[Problem(s) to be Solved by the Invention] By the way, in such a stamp, it is thought by the ability checking the hysteresis of a compact disk that an illegal copy is discriminable with the existence of this stamp. However, this stamp has a fault with it difficult [to reproduce depending on the optical pickup of a compact disc player] by aiming at the check by viewing. When this identifies an illegal copy with a stamp, in order to reproduce a stamp, the playback device of dedication is needed separately after all.
[0006] Moreover, by being recorded by the same approach as the usual pit, the sign recorded by these approaches could be reproduced by exfoliating the protective coat and aluminum reflective film of a compact disk, and creating La Stampa, and had the problem copied illegally by this.
[0007] It is thought by the optical pickup which reproduces audio data without affecting playback of the audio data based on a pit train in any way by these that an illegal copy can be eliminated using this 2nd information if copying refreshable depending on an illegal copy can record the information on ** difficult.
[0008] Copying refreshable depending on an illegal copy by the optical pickup which reproduces the data based on this pit train etc. without having made this invention in consideration of the above point and affecting playback of the data based on a pit train etc. in any way tends to propose the optical disk recording apparatus which can record the data stream of **, the optical disk record approach, and the optical disk created by these difficult.
[0009]
[Means for Solving the Problem] in order to solve this technical problem -- this invention -- setting -- an optical disk recording apparatus and the optical disk record approach -- setting -- the pit more than predetermined die length -- and -- or a land or a mark -- and -- or it is the part which estranged only predetermined

distance from the pit or the edge of a mark about the tooth space based on the data stream of **, and the reflection factor of an information recording surface is changed locally, and the data stream of ** is recorded.

[0010] moreover, an optical disk -- setting -- the pit more than predetermined die length -- and -- or a land or a mark -- and -- or the reflection factor of an information recording surface changes locally, the data stream of ** is recorded, and it is made to consist of a pit or an edge of a mark about a tooth space in the part which estranged only predetermined distance

[0011] the pit more than predetermined die length -- and -- or a land or a mark -- and -- or a reflection factor can be locally changed about a tooth space in the part which estranged only predetermined distance from the edge, without affecting the timing of this edge in any way, when changing the reflection factor of an information recording surface locally. This records the data stream of ** by change of this reflection factor, and the data stream of ** can be recorded on playback of the main data based on a pit train etc. without affecting it in any way. Moreover, change of a reflection factor carried out in this way can record the data stream of ** refreshable by appearing as quantity of light change of return light by the optical pickup which reproduces the main data streams by a pit train etc. In the data stream of ** which carried out still in this way and was recorded, it can copy only with the equipment which has the recording system which records the data stream of this **. Moreover, it becomes difficult to copy depending on the technique of removing the reflective film and creating La Stampa. That this copies depending on an illegal copy can record the data stream of ** difficult.

[0012] thereby -- an optical disk -- setting -- the pit more than predetermined die length -- and -- or a land or a mark -- and -- or about a tooth space, when the reflection factor of an information recording surface changes locally and it comes to record the data stream of **, a copy can be eliminated effectively in the part which estranged only predetermined distance from the pit or the edge of a mark.

[0013]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained in full detail, referring to a drawing suitably.

[0014] (1) The block diagram 2 of the gestalt of operation of the gestalt (1-1) 1st of the 1st operation is a timing diagram which shows a format of the compact disk concerning the gestalt of this operation with the cross-section structure of this compact disk. The disk substrate 2 is created by this compact disk 1 with injection molding, such as a polycarbonate using a stamper, like (drawing 2 (D)) and the usual compact disk. The shape of detailed toothing on this injection molding and corresponding to a pit and a land in the disk substrate 2 is formed in an information recording surface side here. Furthermore, the protective coat 4 which the reflective recording surface 3 which reflects a laser beam in the information recording surface side of this disk substrate 2 is formed of vacuum evaporationo, and protects the

reflective recording surface 3 continuously by it is formed so that a compact disk 1 may be partially expanded with an arrow head a and may be shown (drawing 2 (E)).
[0015] It is made as [record / an audio signal etc. / by this / a compact disk 1 / by the repeat of a pit and a land / like the usual compact disk], and the disk substrate 2 is penetrated, a laser beam L is irradiated at the reflective recording surface 3, and it is made by receiving the return light as [reproduce / the audio signal which carried out in this way and was recorded].
[0016] Like the usual compact disk, 75 CD frames are assigned per second (drawing 2 (A)), and 98 EFM frames are assigned to each CD frame by the repeat of the pit formed by doing in this way here, and a land, respectively (drawing 2 (B)). Furthermore, each EFM frame is divided into the channel clock of 588, and a frame sink is assigned to the 22-channel clock of the head of them. A pit and a land make one period of this one-channel clock a primitive period T, it is repeated by the die length of the integral multiple of this primitive period, and the reflective recording surface 3 is created in the gestalt of this operation in a frame sink by the pan currently made as [create /, respectively / by periodic 11T] according to the same membrane structure as the information recording surface of CD-R. Thereby, if a laser beam L is irradiated more than with the predetermined quantity of light, a compact disk 1 is constituted so that the reflection factor of the reflective recording surface 3 in this laser-beam exposure location may change reversibly, and is made as [detect / change of this reflection factor / quantity of light change of return light].
[0017] Drawing 1 is the block diagram showing the finishing equipment of this compact disk. A disk identification code is recorded by this finishing equipment 10, and a compact disk 1 is shipped.
[0018] That is, in this finishing equipment 10, a spindle motor 11 carries out the rotation drive of the compact disk 1 according to the conditions of a constant linear velocity by control of the servo circuit 12.
[0019] An optical pickup 13 receives the return light while irradiating a laser beam at a compact disk 1, and it outputs the regenerative signal RF with which signal level changes according to the quantity of light of return light. At this time, by control of the APC (Automatic Power Control) circuit 14, an optical pickup 13 starts the quantity of light of a laser beam to predetermined timing, and, thereby, changes locally the reflection factor of the reflective recording surface 3 in a compact disk 1.
[0020] An amplifying circuit 15 amplifies and outputs this regenerative signal RF by Sadatoshi Tokoro profit. The binary-ized circuit 16 makes binary the regenerative signal outputted from an amplifying circuit 15 with predetermined reference level, and outputs the binary-ized signal BD. The PLL circuit 17 reproduces the channel clock CK from this binary-ized signal BD.
[0021] The alignment pattern detector 18 detects the sink pattern which appears repeatedly in the binary-ized signal BD. That is, as contrast with drawing 2 shows to drawing 3 (A-1) - (A-4), after the period of periodic 11T and signal level start, the

binary-ized signal BD continues in the frame sink which signal level switched corresponding to the pit train formed in the compact disk 1, and was assigned to the head of each frame, and the period of periodic 11T and signal level fall. The alignment pattern detector 18 detects this frame sink by judging the signal level which the binary-ized signal BD follows on the basis of the channel clock CK by the flip-flop circuit which made multistage connection. Furthermore, the alignment pattern detection pulse SY to which signal level starts is outputted during the head of each frame, and the period T of an one-channel clock from the detection result of this frame sink (drawing 3 (C)).

[0022] The alignment pattern prediction circuit 19 is constituted by the ring counter which counts the channel clock CK on the basis of the alignment pattern detection pulse SY, and outputs the frame pulse FP to which signal level starts during the head of each frame, and the period T of an one-channel clock (drawing 3 (C)). Thereby, even when a defect etc. cannot detect a frame sink correctly in the alignment pattern detector 18, the alignment pattern prediction circuit 19 predicts each frame sink, and outputs the frame pulse FP.

[0023] The disk identification code generating circuit 20 is constituted by sub-code detector 20A and read only memory (ROM) 20B. Sub-code detector 20A reproduces the sub-code information included in the binary-ized signal BD by decoding the binary-ized signal BD here. Furthermore, the disk identification code generating circuit 20 outputs the hour entry of a part (AMIN) and a second (ASEC) alternatively from the hour entry by part to be contained in this sub-code information, the second, and the frame.

[0024] In addition, the hour entry of a part (AMIN) and a second (ASEC) is the sub-code information set to the specification of a compact disk 1, and shows the location of the data on a compact disk 1 here. That is, the hour entry of a part (AMIN) can express the data recorded on the compact disk 1 per part, for example, can take the values from zero to 74. Moreover, the hour entry of a second (ASEC) specifies further the location of the part unit defined by the part (AMIN) finely per second, and takes the values from 0 to 59.

[0025] Read-only-memory 20B holds the disk identification code ED, and outputs a part (AMIN) to be outputted from sub-code detector 20A, and the data which held by making the hour entry of a second (ASEC) into the address. The disk identification code ED is constituted by the information which controls ID information set up as a peculiar thing for every disk, the information concerning a plant, the date of manufacture, and copy good / failure, and a synchronizing signal, an error correcting code, etc. showing the beginning of a disk identification code are contained here. Read-only-memory 20B holds the disk identification code ED with bit data, and outputs the 1-bit disk identification code ED to the address of 1 by the hour entry of a part (AMIN) and a second (ASEC). Thereby, read-only-memory 20B outputs the 1 bit [per second] disk identification code ED.

[0026] A modulation circuit 21 starts the control signal MX of the APC circuit 14 to predetermined timing according to this disk identification code ED, starts the quantity of light of a laser beam momentarily by this, and changes the reflection factor of a compact disk 1 locally.
[0027] As shown in drawing 4 , it sets to a modulation circuit 21. Namely, the M sequence generating circuit 23 It is constituted by two or more flip-flops and IKUSUKURUSHIBUOA circuits by which cascade connection was carried out. After setting initial value to the flip-flop of these plurality by the timing corresponding to change of the hour entry of a second (ASEC), while carrying out the sequential transfer of the set contents synchronizing with the frame pulse FP Logic 1 and logic 0 generate the random-number data MS of an M sequence which appear in same probability by returning by predetermined interstage. Thereby, the M sequence signal MS serves as a sequence of the pseudo-random number which repeats the same pattern with the period corresponding to 1 bit of the disk identification code ED.
[0028] The IKUSUKURUSHIBUOA circuit 24 receives the M sequence signal MS and the disk identification code ED, and outputs this exclusive-OR signal. That is, the IKUSUKURUSHIBUOA circuit 24 outputs an exclusive-OR signal with the logical level of the M sequence signal MS, when the disk identification code ED is logic 0, and when the disk identification code ED is logic 1 contrary to this, it outputs the exclusive-OR signal which comes to be reversed of the logical level of the M sequence signal MS. The IKUSUKURUSHIBUOA circuit 24 will modulate the disk identification code ED with an M sequence random number by this.
[0029] Cascade connection of the flip-flops 22A-22P is carried out, and the frame pulse FP is inputted into flip-flop 22A of the first rank. These flip-flops 22A-22P transmit this frame pulse FP one by one synchronizing with the channel clock CK.
[0030] OR circuit 25 receives an output from flip-flop 22P of the last stage which becomes the 5th step of flip-flop 22E among these flip-flops 22A-22P in the 16th step, and outputs these OR signals. Thereby, if signal level will start only in one-channel clock period T if a frame sink starts OR circuit 25 and the period for five periods of the channel clock CK passes, and a frame sink begins and the period for 16 periods of the channel clock CK passes, only one-channel clock period T will output pulse signal WP with which signal level starts. In carrying out, the period to write and when the signal level of this pulse signal WP starts is one-channel clock period [of the center of each of the pit of periodic 11T which form a sink pattern, and the land of periodic 11T] T, and corresponds to the location which estranged only sufficient distance from a pit and both the edges of a land, respectively.
[0031] AND circuit 26 outputs the exclusive-OR signal outputted from the IKUSUKURUSHIBUOA circuit 24, and an AND signal with this pulse signal WP as a quantity of light control signal MX of the APC circuit 14 (drawing 3 (D)).
[0032] The APC circuit 14 (drawing 1 </A>) switches the quantity of light of a laser beam to the quantity of light at the time of record from the quantity of light at the

time of playback according to this quantity of light control signal MX . The quantity of light at the time of record is sufficient quantity of light to change the reflection factor of the reflective recording surface of a compact disk 1 here.

[0033] The system control circuit 28 is constituted by the computer which controls actuation of this finishing equipment 10 whole, makes an optical pickup 13 seek on the basis of the sub-code detected by sub-code detector 20A, and records the above-mentioned disk identification code ED about the predetermined field of a compact disk 1.

[0034] thereby, finishing equipment 10 starts the quantity of light of a laser beam according to the disk identification code ED which is with the center of the pit of periodic 11T which form a sink pattern, and a center with the land of periodic 11T, and was modulated with the random-number data MS, and carries out additional record of the disk identification code ED (drawing 3 (E-1) -- and (E-2)). Therefore, in a compact disk 1, when additional record of the disk identification code ED has not been carried out When additional record of the disk identification code ED is carried out in this way on these pits and lands to the regenerative signal RF by the signal wave form saturating to about 1 constant value being acquired (drawing 3 (F-1)), a pit and near the center of a land The regenerative signal RF with which signal level comes to change locally according to the property of the reflective recording surface 3 will be acquired (drawing 3 (F-2)). As for a compact disk 1, the disk identification code ED is reproduced on the basis of change of the signal level of this regenerative signal RF.

[0035] Drawing 5 is the block diagram showing the compact disc player which plays this compact disk 1. In this compact disc player 30, a spindle motor 32 carries out the rotation drive of the compact disk 1 according to the conditions of a constant linear velocity by control of the servo circuit 33.

[0036] An optical pickup 34 receives the return light while irradiating a laser beam at a compact disk 1, and it outputs the regenerative signal RF with which signal level changes according to the quantity of light of return light. Signal level will change here corresponding to the pit where this regenerative signal RF was recorded on the compact disk 1. The signal level of a regenerative signal RF will change according to change of the reflection factor by the disk identification code ED by being formed in the compact disk 1, at this time, so that a reflection factor may change with records of the disk identification code ED locally. However, when only predetermined distance is estranged and the reflection factor is changing locally from the edge of these pits and a land about the pit and land of periodic 11T, the timing which crosses the reference level for binary discernment of the signal level of a regenerative signal RF in these pits and a land is maintained by the same timing as the case where the reflection factor is not changing at all.

[0037] By these, the binary-ized circuit 35 makes this regenerative signal RF binary with predetermined reference level, and creates the binary-ized signal BD. Since

change of the local reflection factor in a compact disk 1 in carrying out to write becomes in the pit which is periodic 11T, and the center of a land, change of this local reflection factor will be detected in the binary-ized signal BD.
[0038] The PLL circuit 36 reproduces the channel clock CCK of a regenerative signal RF by operating on the basis of this binary-ized signal BD.
[0039] The EFM demodulator circuit 37 reproduces the playback data corresponding to the eight-to-fourteen modulation signal S2 by carrying out the sequential latch of the binary-ized signal BD on the basis of the channel clock CCK. Furthermore, after the EFM demodulator circuit 37 carries out the EFM recovery of this playback data, on the basis of a frame sink, it carries out the day interleave of the signal of a break and generated 8 bitwises by 8 bitwises, and outputs this recovery data to the ECC (Error Correcting Code) circuit 38.
[0040] Based on the error correcting code added to the output data of this EFM demodulator circuit 37, the ECC circuit 38 carries out error correction processing of these output data, and, thereby, reproduces and outputs the audio data D1.
[0041] The digital-to-analog conversion circuit (D/A) 39 carries out digital-to-analog transform processing of the audio data D1 outputted from this ECC circuit 38, and outputs audio signal S4 which becomes with an analog signal. At this time, the digital-to-analog conversion circuit 39 will stop the output of audio signal S4, if this compact disk 1 is judged to be what is depended on an illegal copy by control of the system control circuit 40.
[0042] The system control circuit 40 is constituted by the computer which controls actuation of this compact disc player 30. The system control circuit 40 carries out halt control of the output of audio signal S4 from the digital-to-analog conversion circuit 39, when the whole actuation is controlled in advance to access the predetermined field of a compact disk 1, and it judges whether it is what a compact disk 1 depends on an illegal copy based on the disk identification code ED outputted from the disk identification code regenerative circuit 41 and it is judged to be what is depended on an illegal copy it. [it]
[0043] The disk identification code regenerative circuit 41 decodes and outputs the disk identification code ED from a regenerative signal RF.
[0044] Drawing 6 is the block diagram showing this disk identification code regenerative circuit 41 in a detail. In this disk identification code regenerative circuit 41, the alignment pattern detector 43 carries out the sequential latch of the binary-ized signal BD on the basis of the channel clock CCK, and detects a sink pattern by judging that continuous logical level. Furthermore, the alignment pattern detector 43 outputs the frame pulse FP to which signal level starts during the period T of the one-channel clock which each frame starts on the basis of this detected sink pattern.
[0045] After the M sequence generation circuit 45 initializes the address to predetermined timing by control of the system control circuit 40, it carries out stepping of the address one by one by the frame pulse FP, accesses a built-in read-

only memory, and generates the M sequence random-number data MZ corresponding to the M sequence random-number data MS which this generated with finishing equipment 10.
[0046] The analog-to-digital-conversion circuit (A/D) 47 carries out analog-to-digital-conversion processing of the regenerative signal RF on the basis of the channel clock CCK, and outputs a 8-bit digital regenerative signal. The polarity-reversals circuit (-1) 48 reverses and outputs the polarity of this digital regenerative signal.
[0047] A selector 49 carries out the selection output of the digital regenerative signal by which a direct input is carried out from the analog-to-digital-conversion circuit 47, and the digital regenerative signal which comes to be reversed of the polarity inputted from the polarity-reversals circuit 48 according to the logical level of the M sequence random-number data MZ outputted from the M sequence generation circuit 45. That is, a selector 49 chooses and outputs the digital regenerative signal by which a direct input is carried out when the M sequence random-number data MZ are logic 1, and when M sequence random-number data are logic 0 contrary to this, it chooses the digital regenerative signal by which polarity reversals were carried out. Thereby, this selector 49 will reproduce the logical level of the disk identification code ED modulated with the M sequence random-number data MS with the data of a multiple value, and outputs the playback data RX based on the data of this multiple value.
[0048] The pit central detector 50 is constituted by the OR circuit which undergoes the predetermined output of 16 steps of flip-flops by which cascade connection was carried out, and these flip-flops like the modulation circuit 21 in finishing equipment 10. The pit central detectors 50 are the center of the pit of periodic 11T, and the center of the land of periodic 11T by carrying out the sequential transfer of the frame pulse FP with these flip-flops, and only one-channel clock period T outputs the center-section detecting signal CT to which signal level starts.
[0049] The sub-code detector 51 supervises the binary-ized signal BD on the basis of the channel clock CCK, and decodes sub-code information from this binary-ized signal BD. Furthermore, the sub-code detector 51 supervises the hour entry of this decoded sub-code information, and whenever this hour entry changes for 1 second, it outputs the 1-second detection pulse SECP to which signal level starts.
[0050] An adder 52 is a 16-bit digital adder, and adds and outputs the playback data RX and the output data AX of an accumulator (ACU) 53. An accumulator 53 consists of 16-bit memory holding the output data of an adder 52, and constitutes an accumulation machine with an adder 52 by returning the held data to an adder 52. That is, an accumulator 53 records the output data of an adder 52 by the timing of the center-section detecting signal CT, after clearing the contents held by the detection pulse SECP for 1 second. Thereby, an adder 52 accumulates the logical value of the playback data RX reproduced by the selector 49 for every (7350 inter-frame) second of the hour entry using sub-code information, and outputs the

accumulation value AX.
[0051] The binary-ized circuit 54 is the timing to which the detection pulse SECP starts for 1 second, makes the output data AX of an accumulator 53 binary with a predetermined reference value, and outputs. The playback data RX of the disk identification code ED reproduced by the selector 49 by this are changed into the binary disk identification code ED.
[0052] The ECC circuit 55 carries out error correction processing of the disk identification code ED with the error correcting code added to this disk identification code ED, and outputs.
[0053] (1-2) In the configuration beyond actuation of the gestalt of the 1st operation, the disk substrate 2 is created by the production process of the compact disk 1 concerning the gestalt of this operation by the stamper which the mother disk was created by usual mastering equipment, and was created from this mother disk. Furthermore the reflective recording surface 3 and a protective coat 4 are formed in this disk substrate 2, and a compact disk 1 is created (drawing 2). Thereby, the pit and land by die length of an integral multiple of the basic die length corresponding to the predetermined primitive period T in a compact disk 1 are repeated, and a digital audio signal etc. is recorded.
[0054] At this time, when the same membrane structure as the information recording surface of CD-R is applied to the reflective recording surface 3 and this irradiates a laser beam L more than with the predetermined quantity of light, the reflection factor of the reflective recording surface 3 in this laser-beam exposure location changes reversibly, and in addition to the main data recorded by the repeat of a pit and a land, a compact disk 1 is constituted so that additional record of the data of ** can be carried out.
[0055] Thus, the disk identification code ED is recorded on this predetermined field so that a predetermined field may be reproduced by control of the system control circuit 28 and the created compact disk 1 may not affect at all playback of the digital audio signal recorded by the repeat of a pit and a land in finishing equipment 10 (drawing 1).
[0056] That is, in finishing equipment 10, the regenerative signal RF acquired from an optical pickup 13 is changed into the binary-ized signal BD by the binary-ized circuit 16, and a sink pattern is detected from the binary-ized signal of an alignment pattern detector 18 smell lever. The timing of initiation of these pits and a land is detected about the pit and land of periodic 11T with the longest die length among the pit formed in the compact disk 1 by this, and a land.
[0057] In the alignment pattern prediction circuit 19 which furthermore continues, even when the frame pulse FP to which signal level starts to the timing of initiation of a sink pattern is generated and the binary-ized signal BD is not correctly reproduced by the defect etc. by this, the timing of initiation is detected by right timing about the pit and land of periodic 11T.

[0058] Furthermore, the sequential transfer of this frame pulse FP is carried out with Flip-flops 22A-22P, the 5th step and the 16th step of output from a flip-flop are compounded by OR circuit 25 in a modulation circuit 21 (drawing 4), and, thereby, one-channel clock period [of the central part of a pit] T and one-channel clock period T of the central part of a land are detected about the pit and land of these periodic 11T.
[0059] These are interlocked with, a sub-code is reproduced in sub-code detector 20A (drawing 1), the information which pinpoints a playback location by the part (AMIN) and the second (ASEC) from this sub-code is detected, and the disk identification code ED is outputted from continuing read-only-memory 20B corresponding to the information which pinpoints these playback location. The disk identification code ED is outputted by the very low bit rate of 1 bit per second by outputting the disk identification code ED which held the disk identification code ED using bit information, and read-only-memory 20B was accessed by the information on a part (AMIN) and a second (ASEC), and held at this time.
[0060] Moreover, in the M sequence generating circuit 23, synchronizing with the frame pulse FP, the M sequence random-number data MS which logic 1 and logic 0 generate in same probability are generated, and the disk identification code ED is modulated with this M sequence random-number data MS in the IKUSUKURUSHIBUOA circuit 24. Furthermore, in AND circuit 26, the gate of the output of this IKUSUKURUSHIBUOA circuit 24 is carried out by the output of OR circuit 25, and the control signal MX with which signal level starts in the pit of periodic 11T and each central part of a land is generated according to the disk identification code ED modulated with the M sequence random-number data MS by this.
[0061] The quantity of light of a laser beam is risen by this control signal MX, the reflection factor of the reflective recording surface 3 changes locally, a mark is locally formed in the pit of periodic 11T, and each central part of a land by this, and, as for a compact disk 1, the disk identification code ED is formed.
[0062] By forming such a mark in a central part in the pit and land of periodic 11T, in the regenerative signal which changes according to this pit and land, these pits and the signal level corresponding to each edge of a land are with the case where a mark is formed, and the case where the mark is not formed at all, and are held at equal signal level. The disk identification code ED which becomes by the data of ** is recorded without this affecting playback of the main data based on a pit and a land in any way.
[0063] That is, if the wavelength of NA and a laser beam is placed for the numerical aperture of the optical system which reproduces the data based on this kind of pit train with lambda, the optical spot of a diameter D1 with which it is expressed by the degree type will be formed in the information recording surface of a compact disk 1. In addition, a diameter D1 is the half-value width in an optical spot here.

[0064]
[Equation 4]

[0065] If only distance D1 is estranged and a mark is formed from the edge of order by this, in an optical spot, a mark and an edge will be scanned to coincidence. On the other hand, the positional information of an edge sets the average level of a regenerative signal RF as a threshold, it is the timing to which the signal level of a regenerative signal RF crosses this threshold, and this timing corresponds to the timing to which the core of an optical spot crosses an edge. In this timing, when the light beam is not irradiating the mark at coincidence, it is held identically to the case where the timing which crosses this threshold does not form the mark at all.
[0066] The disk identification code ED which becomes by the data of ** can be reproduced without affecting playback of the main data based on a pit and a land in any way, if only this distance D1 is estranged and a mark is formed from the edge of order in distance D1, as the diameter D1 of (4) types is set to one half by this and it is shown in a degree type.
[0067]
[Equation 5]

[0068] The general numerical aperture NA in a compact disc player is a value 0.45 here, and since wavelength lambda is 0.78 [mum], if (5) types are solved, it will be set to D= 1.06 [mum]. If a compact disk 1 estranges only the distance equivalent to a four-channel clock period and forms a mark from an edge, it will mean that it is estranged from one or more distance D by (5) types, and an edge, and had created the mark since it rotated with linear velocity 1.2 [m/sec] and the frequency of the channel clock CK became by 4.3218 [MHz].
[0069] That is, from the edge of a pit and a land, if only distance [/ more than abbreviation period 4T] is estranged and a mark is formed, the pit similarly detected by quantity of light change of return light and the edge information on a land, and the information by the mark can be separated, and it can reproduce. The disk identification code ED which becomes by the data of ** is recorded without this affecting playback of the main data based on a pit and a land in any way.
[0070] Moreover, when logic 1 and logic 0 modulated the disk identification code ED with the M sequence random-number data MS which appear in same probability at this time, change of the regenerative signal RF by change of a reflection factor is observed like the noise mixed in a regenerative signal RF, and, thereby, can make the disk identification code ED observation and discovery difficulty. Furthermore, the copy of the disk identification code ED can also be made difficult.
[0071] Moreover, even if it changes a regenerative signal by a noise etc. having

assigned 1 bit of the disk identification code ED at the period for 1 second, i.e., by distributing and recording this 1 bit on a 7350(7350= 75x98) CD frame in all, in addition to these, the disk identification code ED is certainly reproducible.
[0072] Although the compact disk 1 which did still in this way and recorded the disk identification code ED will be copied about the digital audio signal D1 by the pit train depending on the technique of the conventional illegal copy, about the disk identification code ED, copying becomes difficult.
[0073] That is, to create an illegal copy identically to this compact disk 1, it is necessary to prepare the disk-like record medium which it is necessary to record the disk identification code ED by the mark similarly, and a digital audio signal D1 is recorded by the pit train in advance, and has the reflective recording surface. Moreover, it is necessary to prepare this finishing equipment 10 and the equipment by the same configuration. About this disk identification code ED, it is recordable on copy difficulty with these.
[0074] That is, by detecting the regenerative signal RF with which signal level changes according to the quantity of light of the return light obtained by the compact disk 1 created by doing in this way irradiating a laser beam in (drawing 5) and a compact disc player 30, the signal level of this regenerative signal RF will change according to the reflection factor of a compact disk 1, corresponding to a pit and a land, and this regenerative signal RF is made binary by the binary-ized circuit 35. Then, after binary discernment of the binary-ized signal BD is carried out by the EFM demodulator circuit 37, it EFM-gets over, and a day interleave is carried out, error correction processing is carried out by the ECC circuit 38, and, thereby, a digital audio signal D1 is reproduced.
[0075] At this time, in a compact disk 1 on the pit and land whose mark from which a reflection factor comes to change locally is periodic 11T And by being formed in the center of the pit and land which were estranged beyond the distance corresponding to periodic 4T from the edge (they are the both sides of a front edge and a back edge) Change of signal level [/ near / each / the edge by having formed this mark] is prevented, and even if it is the compact disk 1 which recorded the disk identification code ED by this, it becomes possible to reproduce correctly with the usual compact disc player.
[0076] Thus, in playback of the digital audio signal D1 performed, when a predetermined field is accessed, the disk identification code ED is reproduced and this disk identification code ED cannot play a compact disk 1 correctly in advance than this field, halt control of the digital-to-analog transform processing by the digital-to-analog conversion circuit 39 is carried out as an illegal copy.
[0077] Namely, in playback (drawing 6) of this disk identification code ED, in the alignment pattern detector 43, a frame sink is detected and, as for a compact disk 1, the M sequence random-number data MZ corresponding to the M sequence random-number data MS at the time of record are generated in the M sequence generation

circuit 45 on the basis of detection of this frame sink.
[0078] Moreover, a regenerative signal RF is changed into a digital regenerative signal by the analog-to-digital-conversion circuit 47, and the playback data RX which come to express the logical level of the disk identification code ED with the data of a multiple value are reproduced by choosing the digital regenerative signal which comes to be reversed of this digital regenerative signal or a polarity with a selector 49 on the basis of the M sequence random-number data MZ.
[0079] In a compact disk 1, this playback data RX is accumulated per 1 second by the accumulator 53 and the adder 52, and, thereby, an SN ratio is improved. Moreover, after this accumulation result is made binary by the binary-ized circuit 54 and the disk identification code ED is decoded, error correction processing is carried out by the ECC circuit 55, and it is outputted to the system control circuit 40.
[0080] (1-3) According to the configuration beyond the effectiveness of the gestalt of the 1st operation, detect the pit and land of a sink pattern which become by periodic 11T. By having formed the mark in the center of the these pits and land which were estranged T or more [periodic 4], and having recorded the disk identification code from the edge Without changing a pit and the reflective film of a land locally to the timing which does not affect the positional information of an edge and affecting playback of the digital audio signal D1 by the pit train in any way Copying refreshable depending on an illegal copy by the optical pickup which reproduces this digital audio signal D1 can record a disk identification code difficult.
[0081] Moreover, about the pit and land of a sink pattern which were recorded regularly, a disk identification code is simply recordable by recording a disk identification code by the mark using this regularity.
[0082] Moreover, by assigning and recording 1 bit of a disk identification code on the pit and land of the sink pattern assigned in about 1 second at this time, the effect of a noise etc. can be avoided and a disk identification code can be reproduced certainly.
[0083] By becoming irregular with M sequence random-number data, and furthermore, recording this disk identification code, a disk identification code can be recorded on a noise and discernment difficulty, and a disk identification code can be made into discovery and analysis difficulty. Moreover, at the time of playback, the effect of a noise can be avoided effectively and a disk identification code can be reproduced.
[0084] Moreover, by having formed this mark with the die length corresponding to a primitive period T, similarly, a disk identification code can be recorded on a noise and discernment difficulty, and a disk identification code can be made into discovery and analysis difficulty.
[0085] Moreover, in a compact disc player, the disk identification code ED recorded on a noise and discernment difficulty is certainly reproducible by removing the effect of the noise which detected the signal level of a regenerative signal RF, decoded the disk identification code, accumulated this signal level, and was mixed in the disk identification code.

[0086] Moreover, ** which reproduces certainly the disk identification code recorded on discovery and analysis difficulty is made by processing a digital regenerative signal alternatively with the M sequence random-number data MZ in a selector 49, and reproducing a disk identification code.
[0087] (2) Gestalt drawing 7 of the 2nd operation is the block diagram showing the finishing equipment concerning a gestalt in operation of the 2nd of this invention. This finishing equipment 60 detects the pit beyond periodic 9T, and records the disk identification code ED on these pits. In addition, in the configuration shown in this drawing 7 , the same configuration as the finishing equipment 10 of drawing 1 attaches a corresponding sign, it is shown and the duplicate explanation is omitted.
[0088] That is, in this finishing equipment 60, the system control circuit 61 is constituted by the computer which controls actuation of this finishing equipment 60 whole, controls actuation of an optical pickup 13 on the basis of the sub-code detected from a regenerative signal RF, and traces the field set as the record section of the disk identification code ED by this by the optical pickup 13 by a unit of 2 times one by one.
[0089] At this time, the system control circuit 61 switches a trace signal T1 to logic 1 to holding a trace signal T1 in logic 0 in the 1st trace in the 2nd trace which continues and scans the part scanned by 1st trace. In addition, the 1st trace is for detecting the pit beyond periodic 9T here, and the 2nd trace is for carrying out additional record of the disk identification code from this detection result in the pit beyond periodic 9T.
[0090] Or more [9] T pattern detector 62 detects the pit beyond periodic 9T by detecting the pulse width beyond channel clock 9T in the 1st trace.
[0091] That is, as shown in drawing 8 , or more [9] T pattern detector 62 has 13 steps of flip-flops 64A-64M by which cascade connection was carried out, and inputs the binary-ized signal BD into the first rank of these flip-flops 64A-64M. These flip-flops 64A-64M transmit input data one by one synchronizing with the channel clock CK.
[0092] AND circuits 65A-65C input the output of these flip-flops 64A-64M, respectively, and output an AND signal. At this time, about the first rank, the 2nd step, the 12th step, and the output outputted from the flip-flops 64A, 64B, 64L, and 64M of the last stage, AND circuit 65A starts the logical level of an AND signal, when logical level is reversed and inputted and the output of logic "0011111111100" is obtained by this (i.e., when the logical level corresponding to the pit configuration of die-length 9T continues).
[0093] About the first rank, the 12th step, and the output outputted from the flip-flops 64A, 64L, and 64M of the last stage, continuing AND circuit 65B starts the logical level of an AND signal, when logical level is reversed and inputted and the output of logic "0011111111110" is obtained by this (i.e., when the logical level corresponding to the pit configuration of die-length 10T continues).

[0094] About the output outputted from the flip-flops 64A and 64M of the first rank and the last stage, AND circuit 65C starts the logical level of an AND signal, when logical level is reversed and inputted and the output of logic "0111111111110" is obtained by this (i.e., when the logical level corresponding to the pit configuration of die-length 11T continues).
[0095] OR circuit 66 will output the OR signal MD which serves as logic "1", if which pit of periods 9T, 10T, and 11T is detected by calculating the OR of the output signal outputted from AND circuits 65A-65C. By sampling and shaping this OR signal MD in waveform with the channel clock CK, a flip-flop 67 removes the effect of a glitzy noise etc., and outputs the detection pulse NP.
[0096] Or more [9] T pattern prediction circuit 63 outputs timing signal EP which records a disk identification code in the 2nd trace to recording positional information about the pit beyond periodic 9T in the 1st trace based on this recorded positional information by switching actuation according to the logical level of the trace signal T1 outputted from the system control circuit 61.
[0097] That is, as shown in drawing 9, in or more [9] T pattern prediction circuit 63, the sub-code detector 69 reproduces the positional information (a frame (AFRAME), a second (ASEC), part (AMIN)) of the compact disk 1 currently recorded as a sub-code by processing the binary-ized signal BD on the basis of the channel clock CK. A frame (AFRAME) is the positional information which made for 1 second 75 division into equal parts here. Moreover, the sub-code detector 69 decodes S0 flag (it becomes with the alignment pattern of subcoding) contained in a sub-code, and outputs it as sub-code flag S0FLAG which shows one frame of a sub-code.
[0098] By supervising the logical level which the binary-ized signal BD follows on the basis of the channel clock CK, the alignment pattern detector 70 detects a sink frame, and outputs the sink frame detecting signal SY to which signal level starts to the timing of initiation of each frame.
[0099] The alignment pattern prediction circuit 71 sends out the frame pulse FP which does not have lack using sink frame periodicity, even when it is constituted by the ring counter which counts a channel clock on the basis of this sink frame detecting signal SY and a sink frame is not detected by the defect etc. by this in the alignment pattern detector 70.
[0100] A counter 72 is constituted by the ring counter which counts up the channel clock CK on the basis of the frame pulse FP, and outputs counted value EFMC which becomes by positional information which divides the inside of one EFM frame into 588 by this. Furthermore, a counter 72 counts up the frame pulse FP on the basis of sub-code flag S0FLAG, and creates counted value CDC which becomes by the positional information which divides the CD frame of 1 into 98 equally by this.
[0101] In case counted value EFMC and CDC are outputted, thus, a counter 72 So that counted value EFMC may become a value 0 to the timing to which the frame pulse FP starts (namely, when it is the trace which is the 1st time), when a trace

signal T1 is logic 0 When a trace signal T1 is logic 1 to counting up the continuous channel clock CK (namely, when it is the trace which is the 2nd time), The continuous channel clock CK is counted up so that counted value EFMC may become a value 7 to the timing to which the frame pulse FP starts.
[0102] It is equivalent to a time delay until it outputs timing signal EP by this counted value EFMC here to the laser-beam exposure location where seven periods of the channel clock CK corresponding to this value 7 are specified by counted value EFMC and the quantity of light of a laser beam starts. Thereby, in the 2nd trace, a counter 72 counts up the channel clock CK so that the part of this time delay and counted value EFMC may progress.
[0103] Memory 74 is constituted by the memory which makes the address counted value EFMC and CDC which become by the positional information (a frame (AFRAME), a second (ASEC), part (AMIN)) by the sub-code detector 69, and the positional information by the counter 72, and records the detection pulse NP, and switches actuation according to a trace signal T1. That is, when a trace signal T1 is logic 0, memory 74 records the detection pulse NP which makes such positional information the address and is outputted from or more [9] T pattern detector 62 (namely, when it is the trace which is the 1st time). On the other hand, when a trace signal T1 is logic 1, memory 74 outputs the contents which held by making such positional information into the address as a timing signal EP (namely, when it is the trace which is the 2nd time).
[0104] A modulation circuit 75 is similar with the modulation circuit 21 mentioned above about drawing 4 , and is constituted. That is, cascade connection of the flip-flop of a predetermined number of stages is carried out, and a modulation circuit 75 carries out the sequential transfer of the frame pulse FP with a channel clock period with these flip-flops. Furthermore, a modulation circuit 75 receives an output from the predetermined number of stages of these flip-flops, and thereby, if only periodic 4 T pass from the edge of initiation of this pit in the pit beyond periodic 9T, it will generate the timing signal with which logical level starts only in the period T of an one-channel clock.
[0105] Furthermore, a modulation circuit 75 generates M sequence random-number data on the basis of timing signal EP, and modulates the disk identification code ED with this random-number data. The gate of this modulation result is carried out with the timing signal furthermore generated with the flip-flop, and it outputs as a control signal MX.
[0106] Thereby, finishing equipment 60 is made as [record / a disk identification code] about the pit beyond periodic 9T with which are satisfied of the conditions explaining (5) types.
[0107] That is, in the pit beyond periodic 9T, even if it estranges only periodic 4 T and only periodic 1 T change a reflection factor from an initiation side edge, a reflection factor can be changed, without affecting the positional information of an order edge in

any way. Moreover, in this pit beyond periodic 9T, there is the description that occurrence frequency is high, as compared with the pit and land of periodic 11T. 1 bit of a disk identification code can be recorded on many pits by this, and the dependability of the part disk identification code can be improved.
[0108] When playing the compact disk concerning the gestalt of this operation to write in carrying out, the pattern detector by the same configuration as or more [9] T pattern detector 62 applied to this finishing equipment 60 will detect the pit beyond 9T, the signal level of a regenerative signal RF will be detected about this pit, and a disk identification code will be reproduced.
[0109] According to the 2nd configuration of the gestalt of operation, the pit beyond periodic 9T is detected, and even if it changes the reflection factor of an information recording surface more nearly locally [in the timing which estranged only predetermined distance] than the edge of this pit and records a disk identification code, the same effectiveness as the gestalt of the 1st operation can be acquired. Moreover, time amount which can record a disk identification code using the pit where occurrence frequency is high, and can record the part disk identification code certainly as compared with the gestalt of the 1st operation, and is assigned to 1 bit of a disk identification code if needed can be shortened, and the recording density of a disk identification code can be improved.
[0110] (3) Gestalt drawing 10 of the 3rd operation is the block diagram showing the finishing equipment of the compact disk 1 concerning the gestalt of the 3rd operation. In this finishing equipment 80, pit detection processing beyond periodic 9T and additional record processing of a disk identification code are performed in coincidence juxtaposition. In addition, in the configuration shown in this drawing 10 , the same configuration as the finishing equipment 60 mentioned above about drawing 7 attaches a corresponding sign, it is shown and the duplicate explanation is omitted.
[0111] That is, in the gestalt of this operation, finishing equipment 80 has optical pickup 83B for record to which only predetermined time delays for it and scans the scan locus which optical pickup 83A for precedence read-out and optical pickup 83A for this precedence read-out scanned.
[0112] Thereby, finishing equipment 80 processes the regenerative signal RF acquired from optical pickup 83A for precedence read-out, detects the pit beyond periodic 9T, and records the disk identification code ED from optical pickup 83B for record which carries out backward on the basis of this detection result further.
[0113] That is, a time delay until optical pickup 83B for record scans the scan locus which optical pickup 83A for precedence read-out scanned is compensated by finishing equipment's 80 inputting the detection result NP of or more [9] T pattern detector 62 into FIFO memory 84, carrying out predetermined time delay, and supplying a modulation circuit 75.
[0114] The system control circuit 82 is constituted by the computer which controls actuation of this finishing equipment 80, and makes the record location of a disk

identification code seek optical pickups 83A and 83B.

[0115] According to the configuration shown in drawing 10 , in addition to the same effectiveness as the gestalt of the 2nd operation, the time amount which processing takes can be shortened by performing pit detection processing beyond periodic 9T, and additional record processing of a disk identification code in coincidence juxtaposition.

[0116] (4) In the gestalt of other operations, in addition the gestalt of above-mentioned operation, although the case where the membrane structure of CD-ROM was applied to a reflective recording surface was described, this invention may apply the membrane structure of not only this but a phase-change optical disk.

[0117] Moreover, when estranging T or more [periodic 5] and changing the reflection factor of an information recording surface locally from the edge of a pit in the gestalt of the 1st operation of a ****, it sets in the gestalt of the 2nd and the 3rd operation. When estranging T or more [periodic 4] and changing the reflection factor of an information recording surface locally from the edge of a pit, it attached and stated, but even if it estranges this invention T or more [periodic 3] and it changes the reflection factor of an information recording surface locally from the edge of not only this but a pit, it can acquire the same effectiveness.

[0118] That is, when the edge of a pit is approached and the reflection factor of an information recording surface is changed locally, a jitter will occur in a regenerative signal. However, in an actual compact disc player, even if some jitter arises from a pit to a regenerative signal, a parenchyma top can reproduce the data based on a pit train satisfactory at all.

[0119] Let the minimum reversal spacing be a three-channel clock by the EFM method currently used for the modulation of a compact disk in relation with this jitter. This minimum reversal spacing is specified as a distance which generating of the jitter by that change can almost disregard, even if change of pits, such as reflection factor change, breaks out in the part which separated only this minimum reversal spacing from the edge of a pit. If additional record of the disk identification code ED is carried out in the location which this separated from the edge of a pit more than the minimum reversal spacing, aggravation of the jitter by the disk identification code ED can be maintained to a value small enough, and the data based on a pit train can be reproduced certainly. By following, if it is a compact disk, from the edge of a pit, only the distance corresponding to a three-channel clock can be estranged, a reflection factor can be changed locally, and a disk identification code can be recorded.

[0120] In addition, when estranging only the distance corresponding to a three-channel clock and recording a disk identification code from the edge of a pit in this way, a disk identification code can be recorded on the pit and land beyond periodic 7T.

[0121] Moreover, although the case where a disk identification code was recorded on the pit beyond periodic 9T was described, you may make it record this invention on the pit and land not only this but beyond periodic 9T in the gestalt of the above-

mentioned 2nd and the 3rd operation.
[0122] Although the case where estranged only periodic 4 T and a disk identification code was recorded from the edge by the side of pit initiation was described, you may make it record this invention in the center of each pit not only this but beyond periodic 9T in the pit beyond periodic 9T in the gestalt of further above-mentioned the 2nd and 3rd operation.
[0123] moreover -- although the case where a disk identification code was recorded on the sink frame part which can be predicted was described in the gestalt of the 1st operation of a ****, if this invention can predict not only this but the appearing signal beforehand -- **** -- it is applicable also to a signal [like]. For example, when all or a part of signal recorded on the compact disk is known, it becomes possible to predict the pit train on a disk. Also in this case, it becomes possible to carry out additional record of the disk identification code ED by applying this approach, expecting the location fully distant from the part of the edge of a pit, and increasing a laser output momentarily in the expected location.
[0124] Furthermore, in the gestalt of above-mentioned operation, although it is a pit more than predetermined die length, and a land and the case where only an one-channel clock period changed the reflection factor of an information recording surface locally was described If this invention estranges only predetermined distance from a front edge and a back edge in short not only in this and a reflection factor is changed partially By a disk identification code being recordable, only the central part of periodic 3T may change a reflection factor about the pit and land of periodic 9T, without spoiling edge information.
[0125] Moreover, in the gestalt of above-mentioned operation, although the case where a disk identification code was recorded was described, this invention may record various data required for discharge of encryption, when recording the digital audio signal enciphered not only by this but by a pit and land length, recording key information required for discharge of this encryption and recording data still more nearly required for selection of key information, and decode.
[0126] Moreover, although the case where a disk identification code was recorded was described, this invention is applied not only to this but to a compact disc player, for example, you may make it record the count of playback of data, and the count of a copy by the pit train in the finishing equipment of a compact disk in the gestalt of above-mentioned operation.
[0127] Although the case where the data stream of ** which carries out binary discernment of the accumulation value by the accumulator in the gestalt of above-mentioned operation, and becomes by the disk identification code was reproduced was described, this invention carries out multiple-value discernment not only of this but this accumulation value, and you may make it reproduce the data stream of ** furthermore.
[0128] Moreover, in the gestalt of above-mentioned operation, although the case

where carried out eight-to-fourteen modulation and a digital audio signal was recorded was described, this invention is widely applicable to various modulations, such as not only this but 1-7 modulation, 8-16, 2-7 modulation, etc.

[0129] Moreover, in the gestalt of above-mentioned operation, although the case where desired data were recorded by the pit and the land was described, this invention can be widely applied, not only this but when recording desired data by the mark and the tooth space.

[0130] Moreover, in the gestalt of above-mentioned operation, although the case where an audio signal was recorded on a compact disk and its peripheral device with the application of this invention was described, this invention is widely applicable to various optical disks, such as not only this but a videodisk, and the peripheral device of those.

[0131]

[Effect of the Invention] As mentioned above, according to this invention, to the timing which does not affect the positional information of an edge, copying refreshable depending on an illegal copy by the optical pickup which reproduces this main data stream can record the data stream of ** difficult without affecting playback of the main data streams by a pit train etc. in any way by changing reflective film, such as a pit and a mark, locally.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the finishing equipment of the compact disk concerning the gestalt of operation of the 1st of this invention.

[Drawing 2] It is the sectional view and timing diagram with which explanation of the compact disk finished with the finishing equipment of drawing 1 is presented.

[Drawing 3] It is the timing diagram with which explanation of actuation of the finishing equipment of drawing 1 is presented.

[Drawing 4] It is the block diagram showing the modulation circuit of the finishing equipment of drawing 1 .

[Drawing 5] It is the block diagram showing the compact disc player which plays the compact disk created with the finishing equipment of drawing 1 .

[Drawing 6] It is the block diagram showing the disk identification code regenerative circuit of the compact disc player of drawing 5 .

[Drawing 7] It is the block diagram showing the finishing equipment of the compact disk concerning the gestalt of operation of the 2nd of this invention.

[Drawing 8] It is the block diagram showing or more [9] T pattern detector of the

finishing equipment of drawing 7 .

[Drawing 9] It is the block diagram showing or more [9] T pattern prediction circuit of the finishing equipment of drawing 7 .

[Drawing 10] It is the block diagram showing the finishing equipment of the compact disk concerning the gestalt of operation of the 3rd of this invention.

[Description of Notations]

1 .... A compact disk, 2 .. A disk substrate, 3 .. Reflective recording surface, 4 .... A protective coat, 10, 60, 80 .. Finishing equipment, 13, 83A, 83B .. Optical pickup, 14 .... An APC circuit, 18, 41, 70 .. Alignment pattern detector, 19 71 .... An alignment pattern prediction circuit, 20 .. Disk identification code generating circuit, 20A, 51, 69 [.. A disk identification code regenerative circuit 62 / .. Or more / 9 / T pattern detector 63 / .. Or more / 9 / T pattern prediction circuit,] .... 21 A sub-code detector, 75 .. A modulation circuit, 30 .. A compact disc player, 41